

Possibility of a direction-indicating low frequency MEMS microphone



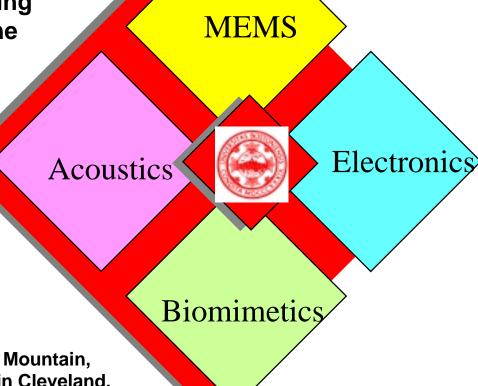
Allan D. Pierce

B.U.G.S.

Boston University

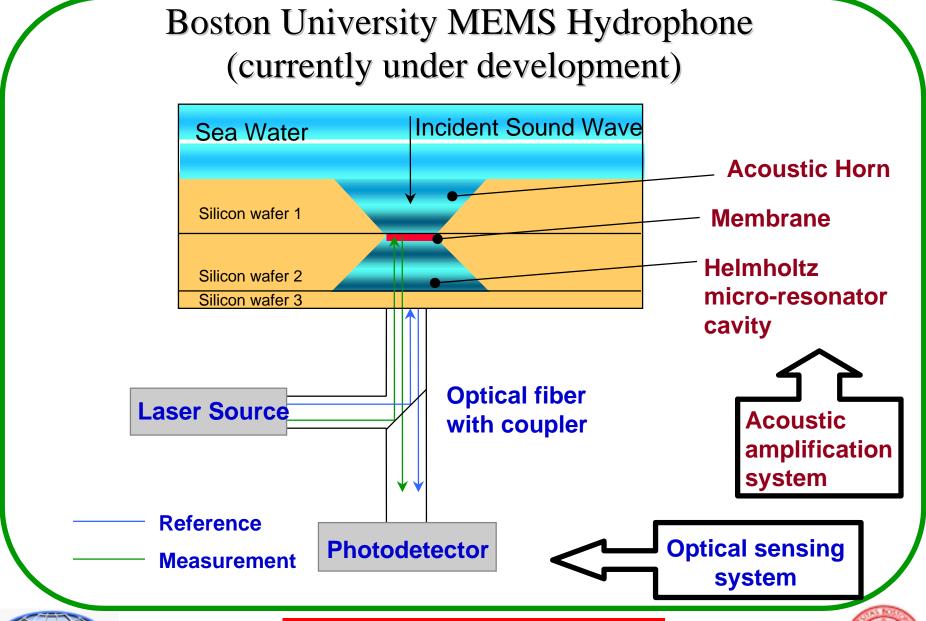
with acknowledgments to

Debora Compton, Tom Bifano, David Mountain, Allyn Hubbard, Harley Johnson, Robin Cleveland, and others







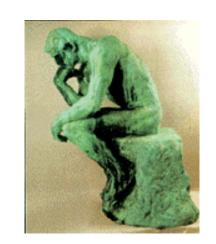




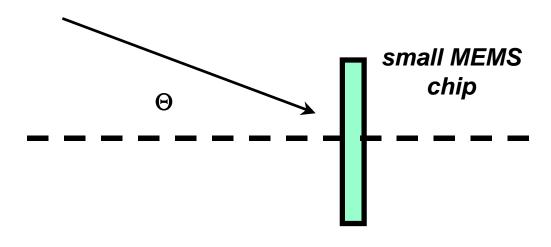


Issue:

Can we build a compact MEMS device that senses acoustic signals in the lower kilohertz range and which nevertheless gives us a good indication of the direction from which the sound is coming?

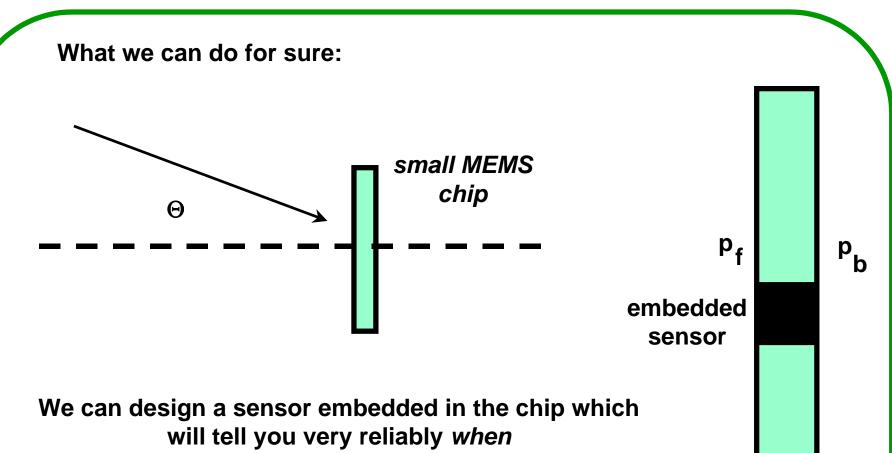










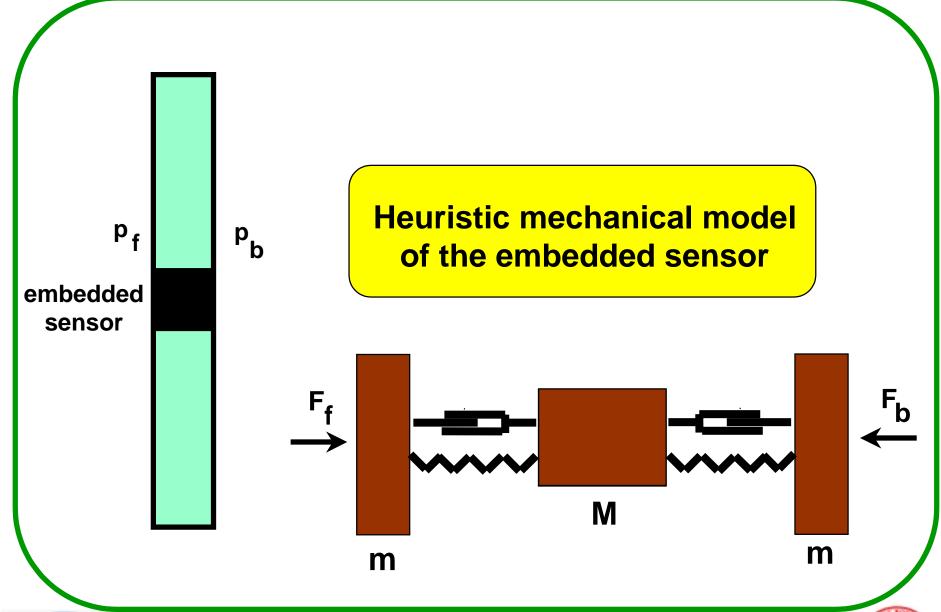


$$\Theta = 0$$

$$p_f \approx p_b, but p_f \neq p_b$$

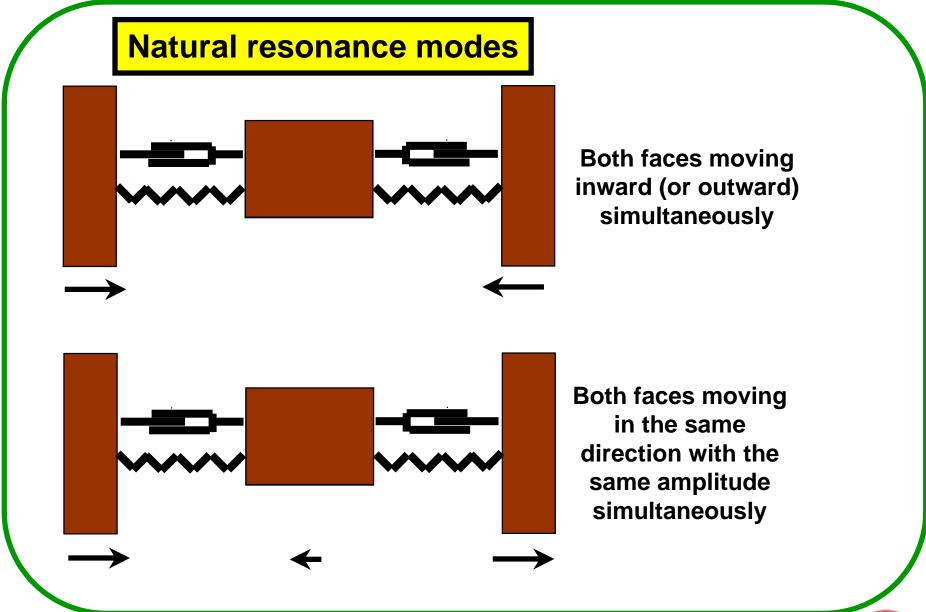






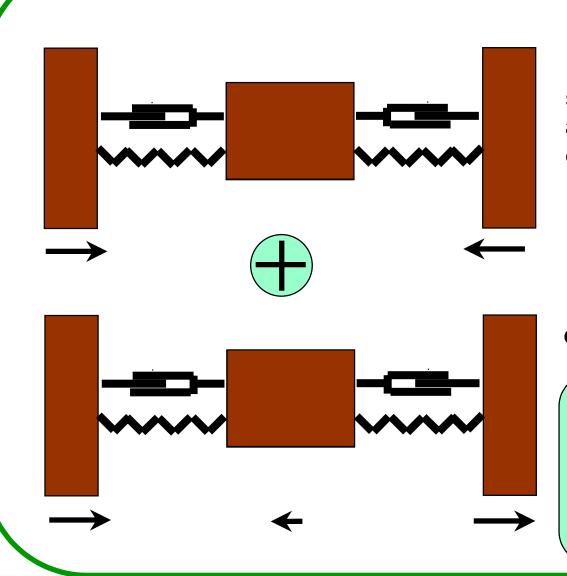












It is possible to excite the system

so that the relative amplitudes and phases of the two modes

are such that

the back face of the sensor

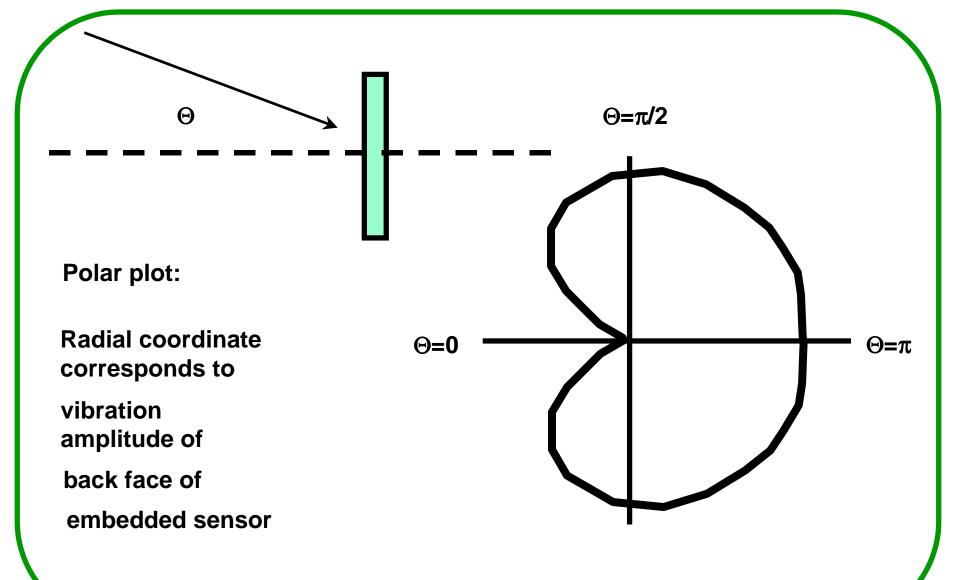
doesn't move at all

Design strategy:

Choose parameters so that this excitation corresponds to Θ=0 for the frequency range of interest











Comments on possible realizations and extensions

 Frequency range must be close to resonance frequency of non-squeezing mode

For fixed chip orientation, azimuth direction determination requires array with some minimum lateral distance requirement

- Can design systems with rotatable chips; rotate until Θ=0 is indicated
- Several sensors on same chip possible, each corresponding to a different choice of Θ, different frequency range

